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2

3 1. An electronically addressable display comprising:

4 a substrate;

5 associated with the substrate, an addressable display bi-modal molecular

6 colorant stratum; and

7 associated with the molecular colorant stratum, an addressing device mounted

8 for selectively switching colorant molecules of the stratum between at least two visually

9 distinguishable states.

10

11 2. The display as set forth in claim 1 comprising:

12 a first of said two distinguishable states is a transparent state.

13

14 3. The display as set forth in claim 2 comprising:

15 a second of said two distinguishable states is an opaque color state.

16

17 4. The display as set forth in claim 1, said bi-modal molecular colorant stratum

18 comprising:

19 a molecular system, said system including electrochromic, switchable molecules,

20 each of said molecules being selectively switchable between said at least two optically

21 distinguishable states, wherein said system is distributable on the substrate thereby

22 forming a display screen region.

23

24 5. The display as set forth in claim 1 comprising:

25 said colorant molecules exhibit an electric field induced band gap change.

26

1 6. The display as set forth in claim 5 comprising:

2 said electric field induced band gap change occurs via a mechanism selected  
3 from a group including (1) molecular conformation change or an isomerization, (2)  
4 change of extended conjugation via chemical bonding change to change the band gap,  
5 and (3) molecular folding or stretching.

6  
7 7. The display as set forth in claim 5 comprising:

8 said electric field induced band gap change occurs via a molecular conformation  
9 change or an isomerization.

10  
11 8. The display as set forth in claim 7 wherein the molecules forming the molecular  
12 system further comprise:

13 at least one stator portion and at least one rotor portion, wherein said rotor  
14 rotates from a first state to a second state with an applied electric field, wherein in said  
15 first state, there is extended conjugation throughout said molecular system, resulting in a  
16 relatively smaller band gap, and wherein in said second state, said extended conjugation  
17 is destroyed, resulting in a relatively larger band gap.

18  
19 9. The display as set forth in claim 7 comprising:

20 dependent upon direction of electrical field applied, in a first of said states said  
21 colorant molecules are in a more conjugated state throughout, having a relatively smaller  
22 band gap, and in a second of said states said colorant molecules are in a less  
23 conjugated state throughout, having a relatively larger band gap.

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26 //

1 10. The display as set forth in claim 5 comprising:

2 said electric field induced band gap change occurs via a change of extended  
3 conjugation via chemical bonding change to change the band gap.

4  
5 11. The display as set forth in claim 10 comprising:

6 said electric field induced band gap change occurs via a change of extended  
7 conjugation via charge separation or recombination accompanied by increasing or  
8 decreasing band localization.

9  
10 12. The display as set forth in claim 11 comprising:

11 a change from a first state to a second state occurs with an applied electric field,  
12 said change involving charge separation in changing from said first state to said second  
13 state, resulting in a relatively larger band gap state, with less  $\pi$ -delocalization, and  
14 recombination of charge in changing from said second state to said first state, resulting  
15 in a relatively smaller band gap state, with greater  $\pi$ -delocalization.

16  
17 13. The display as set forth in claim 5 comprising:

18 said electric field induced band gap change occurs via a change of extended  
19 conjugation via charge separation or recombination and  $\pi$ -bond breaking or formation.

20  
21 14. The display as set forth in claim 13 comprising:

22 a change from a first state to a second state occurs with an applied electric field,  
23 said change involving charge separation in changing from said first state to said second  
24 state, wherein in said first state there is extended conjugation throughout, resulting in a  
25 relatively larger band gap state, and wherein in said second state said extended

1 conjugation is destroyed and separated positive and negative charges are created,  
2 resulting in a relatively smaller band gap state.

3 15. The display as set forth in claim 5 comprising:

4 said electric field induced band gap change occurs via a molecular folding or  
5 stretching.

6  
7 16. The display as set forth in claim 15 comprising:

8 said colorant molecule has three portions, a first portion and a third portion, each  
9 bonded to a second, central portion, wherein a change from a first state to a second  
10 state occurs with an applied electric field, said change involving a folding or stretching  
11 about or of said second portion, wherein in said first state there is extended conjugation,  
12 resulting in a relatively smaller band gap state, and wherein in said second state, said  
13 extended conjugation is destroyed, resulting in a relatively larger band gap.

14  
15 17. The display as set forth in claim 1 comprising:

16 said colorant molecules are arranged to form discrete, addressable picture  
17 elements of said display stratum.

18  
19 18. The display as set forth in claim 17 comprising:

20 said addressing device is configured for switching selected said picture elements  
21 between a transparent state and a colored state.

22  
23 19. The display as set forth in claim 17 comprising:

24 said addressing device is configured for switching selected said picture elements  
25 between two visually distinctive color states.

26 //

- 1     20.     The display as set forth in claim 1 comprising:  
2             said colorant molecules are bistable, providing a non-volatile component.  
3
- 4     21.     The display as set forth in claim 1 comprising:  
5             said colorant molecules have a low activation barrier between different said  
6     states providing a fast volatile switching therebetween.  
7
- 8     22.     The display as set forth in claim 1 comprising:  
9             said colorant molecules have more than two said states, switchable such that  
10            optical properties of said stratum can be tuned either continuously by application  
11            of a decreasing or increasing electric field to form a volatile switch or color of  
12            selected display regions are changed abruptly by application of voltage pulses to  
13            switch at least one molecular activation barrier.  
14
- 15    23.     The display as set forth in claim 1 in a computer apparatus.  
16
- 17    24.     The display as set forth in claim 1 in an electronic appliance.  
18
- 19    25.     The display as set forth in claim 24 wherein said electronic appliance is an  
20     appliance in the group including test and monitoring instruments, musical instruments,  
21     telecommunications devices, personal computing devices, digital photographic devices,  
22     or image projection devices.  
23
- 24    26.     An electronic appliance comprising:  
25            an appliance housing; and

1 incorporated with the housing, a display device, the display device including at  
2 least one writeable imaging stratum forming a pixel array of a bi-modal molecular  
3 colorant, and an addressing device mounted for selectively switching colorant molecules  
4 of the imaging stratum.

5  
6 27. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:  
7 adjacent said imaging stratum, a background stratum in black, white or a  
8 predetermined color, wherein said addressing device switches said colorant molecules  
9 between a transparent orientation and a color-exhibiting orientation such that said  
10 background stratum provides high contrast as viewed through the colorant molecules in  
11 the transparent orientation with respect to the colorant molecules in the color-exhibiting  
12 orientation.

13  
14 28. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:  
15 said imaging stratum further comprising colorant molecules having a first state  
16 wherein a picture element formed of said molecules in said first state are displayed in a  
17 first color, including black or white, and said colorant molecules having a second state  
18 wherein a picture element formed of said molecules in said second state are displayed in  
19 a second color, including white or black, presenting a visually high contrast to molecules  
20 in said first state.

21  
22 29. (FIRST AMENDED) The appliance as set forth in claim 26 wherein said  
23 appliance is selected from a group including computers, computing machines of both  
24 hard-wired, fixed location and portable types, calculators, electronic books, monitoring  
25 instruments, musical instruments or music stands, networked workstations, personal

- 1 digital assistants, telephones, televisions, test instruments, video games, or wired or  
2 wireless communication devices.

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1 30. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

2 said display is a fixed geometry position screen.

3

4 31. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

5 said display is a retractable geometry positionable screen.

6

7 32. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

8 said colorant molecules are arranged to form discrete, addressable picture

9 elements of said display stratum.

10

11 33. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

12 said colorant molecules are bistable, providing a non-volatile component.

13

14 34. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

15 said colorant molecules have a low activation barrier between different said

16 states providing a fast volatile switching therebetween.

17

18 35. (FIRST AMENDED) The appliance as set forth in claim 26 comprising:

19 said colorant molecules have more than two said states, switchable such that optical

20 properties of said stratum can be tuned either continuously by application of a

21 decreasing or increasing electric field to form a volatile switch or color of selected

22 display regions are changed abruptly by application of voltage pulses to switch at

23 least one molecular activation barrier.

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1 36. A visual display comprising:  
2 at least one writeable imaging stratum forming a pixel array of a bi-modal  
3 molecular colorant; and  
4 at least one addressing device mounted for selectively switching colorant  
5 molecules of the imaging stratum.

6  
7 37. (FIRST AMENDED) The display as set forth in claim 36 comprising:  
8 adjacent said imaging stratum, a background stratum in black, white or a  
9 predetermined color, wherein said addressing device switches said colorant molecules  
10 between a transparent orientation and a color-exhibiting orientation such that said  
11 background stratum provides high contrast as viewed through the imaging stratum  
12 regions where the colorant molecules in the transparent orientation with respect to the  
13 colorant molecules in the color-exhibiting orientation.

*As per*

14  
15 38. (FIRST AMENDED) The display as set forth in claim 36 comprising:  
16 said imaging stratum further comprising colorant molecules having a first state  
17 wherein a picture element formed of said molecules in said first state are displayed in a  
18 first color, including black or white, and said colorant molecules having a second state  
19 wherein a picture element formed of said molecules in said second state are displayed in  
20 a second color, including white or black, presenting a visually high contrast to molecules  
21 in said first state.

22  
23 39. (FIRST AMENDED) The display as set forth in claim 36 comprising:  
24 said display is a fixed geometry position screen.

25 //

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1 40. (FIRST AMENDED) The display as set forth in claim 36 comprising:  
2 said display is a retractable geometry positionable screen.

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3  
4 41. The display as set forth in claim 36 comprising:  
5 said colorant molecules are arranged to form discrete, addressable picture  
6 elements of said display stratum.

7 42. The display as set forth in claim 36 comprising:  
8 said colorant molecules are bistable, providing a non-volatile component.

9  
10 43. The display as set forth in claim 36 comprising:  
11 said colorant molecules have a low activation barrier between different said  
12 states providing a fast volatile switching therebetween.

13  
14 44. The display as set forth in claim 36 comprising:  
15 said colorant molecules have more than two said states, switchable such that  
16 optical properties of said stratum can be tuned either continuously by application of a  
17 decreasing or increasing electric field to form a volatile switch or color of selected display  
18 regions are changed abruptly by application of voltage pulses to switch at least one  
19 molecular activation barrier.

20  
21 45. The display as set forth in claim 36 comprising:  
22 a plurality of imaging strata forming a display ensemble wherein each of said  
23 imaging strata includes a pixel array of a bi-modal molecular colorant such that colorant  
24 molecules thereof are selectively switchable between a transparent state and a primary  
25 color state, and

1 associated with each of said imaging strata, addressing devices mounted for  
2 selectively switching colorant molecules of respectively associated imaging stratum of  
3 said imaging strata.

4  
5 46. The display as set forth in claim 36 comprising:

6 said imaging strata is a mosaic pattern of colorant molecules arranged in  
7 addressable picture element groups.

8  
9 47. The display as set forth in claim 46 wherein said mosaic pattern is formed with  
10 ink-jet technology

11 <sup>63</sup>~~48.~~ (NEW) A method for displaying digital data, the method comprising:

12 selectively producing localized electric fields at picture elements of a viewing  
13 screen; and

14 using said fields to induce band gap changes in molecules forming said picture  
15 elements thereby changing an optical property thereof.

16  
17 <sup>48</sup>~~49.~~ The display as set forth in claim 36, said addressing means comprising:  
18 molecular crossbar wiring.

19  
20 <sup>49</sup>~~50.~~ A method of fabricating a rewritable display screen, the method comprising:

21 depositing a substantially homogeneous layer of bi-modal molecular colorant on  
22 a surface; and

23 providing addressable elements adjacent said surface for matrix addressing said  
24 surface as addressable picture elements.

25 //

26 //

50

51. The method as set forth in claim 50 comprising:

forming the molecular colorant having electric field changeable colorant

molecules.

51

52. The method as set forth in claim 51 comprising:

providing said colorant molecules wherein said molecules are at least bi-modal.

52

53. The method as set forth in claim 51 comprising:

providing said colorant molecules wherein said molecules are bistable.

53

54. The method as set forth in claim 50 comprising:

forming each addressable picture element of a set of molecules wherein said

colorant molecules exhibit an electric field induced band gap change.

54

55. The method as set forth in claim 54 comprising:

inducing said band gap change via a mechanism selected from a group including

(1) molecular conformation change or an isomerization, (2) change of extended

conjugation via chemical bonding change, and (3) molecular folding or stretching.

55

56. A method of document retrieval using an internet, the method comprising:

from a telecommunications appliance, ordering the document over the internet;

downloading the document from the internet into the telecommunications

appliance; and

displaying the document on a display associated with the telecommunications

appliance by forming an image of the document on a pixel array of a rewritable bi-modal

molecular colorant.

1 <sup>56</sup>  
~~57.~~ A method of doing business with respect to document publishing and retrieval,  
2 the method comprising:  
3 providing a wireless communications site including a server for publishing  
4 document content; and  
5 downloading from said site to a wireless telecommunications appliance  
6 document content data for read-only display by forming a selectable page-by-page pixel  
7 array on a bi-modal molecular colorant display associated with said appliance.

8  
9 <sup>57</sup>  
~~58.~~ A wireless communications appliance, comprising:  
10 a wireless interface;  
11 a display screen having at least one writeable imaging stratum forming a pixel  
12 array of a bi-modal molecular colorant; and  
13 at least one addressing device mounted for selectively switching colorant  
14 molecules of the imaging stratum.

15  
16 <sup>58</sup>  
~~59.~~ The appliance as set forth in claim 58, said bi-modal molecular colorant  
17 comprising:  
18 a molecular system, said system including electrochromic, switchable molecules,  
19 each of said molecules being selectively switchable between said at least two optically  
20 distinguishable states, wherein said system is distributable on the substrate thereby  
21 forming a display screen region.

22  
23 <sup>59</sup>  
~~60.~~ (FIRST AMENDED) The appliance as set forth in claim 58 comprising:  
24 said colorant molecules exhibit an electric field induced band gap change.

1 <sup>60</sup>~~61~~. (FIRST AMENDED) The appliance as set forth in claim 60  
2 comprising:  
3 said electric field induced band gap change occurs via a mechanism selected  
4 from a group including (1) molecular conformation change or an isomerization,  
5 (2) change of extended conjugation via chemical bonding change to change the  
6 band gap, and (3) molecular folding or stretching.

7  
8 <sup>61</sup>~~62~~. A projection apparatus comprising:  
9 display means for projecting an image, said display means having a transparent  
10 substrate and, associated with said substrate, at least one writeable imaging stratum  
11 forming a pixel array of a bi-modal molecular system; and  
12 associated with said imaging stratum, at least one addressing means for  
13 selectively switching colorant molecules of the imaging stratum forming an image for  
14 projection.

15  
16 <sup>62</sup>~~63~~. An electronically addressable display comprising:  
17 a translucent substrate having a means for backlighting said substrate  
18 associated therewith;  
19 associated with the substrate, an addressable display bi-modal molecular  
20 colorant system; and  
21 associated with the molecular colorant system, an addressing means mounted  
22 for selectively switching colorant molecules of the system between at least two visually  
23 distinguishable states wherein one of said states produces a color of high contrast with  
24 respect to said translucent substrate and another one of said states is transparent.

25 //

26 //

*Revised*  
1 64. (NEW) An electric field addressable viewing screen comprising:  
2 a substrate;  
3 at least one layer of a bi-modal molecular colorant associated with said substrate  
4 such that colorant molecules are addressable as picture elements of the viewing screen,  
5 electrically switching the colorant molecules between at least two visually distinct states  
6 selectively.

*AM Cont*  
7  
8 65. (NEW) The invention as set forth in claim 64 said colorant further comprising:  
9 a bi-modal molecular system for creating alphanumeric characters and graphic  
10 images.

11  
12 66. (NEW) The invention as set forth in claim 65 wherein each of said molecules  
13 exhibit an electric field induced band gap change.

14  
15 67. (NEW) The invention as set forth in claim 66 wherein said electric field induced  
16 band gap change occurs via a mechanism selected from a group including (1) molecular  
17 conformation change or an isomerization, (2) change of extended conjugation via  
18 chemical bonding change to change the band gap, and (3) molecular folding or  
19 stretching.

20  
21 68. (NEW) A method for generating a visual display from a digital data set  
22 representative of text, images, or both, the method comprising:  
23 converting the digital data set to electrical signals for generating individual picture  
24 elements representative thereof; and  
25 sending said signals to local electric field generating devices associated with a  
26 viewing surface, the screen having a molecular colorant stratum such that said signals  
27 induce local electrical fields in said stratum causing said molecules thereof to switch  
28 between at least two optically distinguishable states at said individual picture elements  
29 such that said digital data set is visually displayed thereby.

1 ~~69.~~ (NEW) The method as set forth in claim 68 wherein each of said molecules  
2 exhibit an electric field induced band gap change.

3 ~~69.~~  
4 ~~70.~~ (NEW) The method as set forth in claim 69 wherein said electric field induced  
5 band gap change occurs via a mechanism selected from a group including (1) molecular  
6 conformation change or an isomerization, (2) change of extended conjugation via  
7 chemical bonding change to change the band gap, and (3) molecular folding or  
8 stretching.

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